

Claims 1-6 and 8-18 have been rejected under 35 U.S.C. Section 103 as unpatentable over the Sakata '187 patent in view of the Tsunetomo '256 patent. These rejections are respectfully traversed.

This invention is directed to a photonic crystal grating coupler that couples light out of a waveguide plane. The specification teaches that conventional photonic crystal couplers have periodicity in single dimension and this presents the problem that they couple light out of a waveguide plane in all directions. If the surface of the waveguide plane is planar, as shown in Fig. 1A, the light is scattered out of the plane in a cylindrical pattern (2 of Fig. 1A). And if the waveguide plane has a contoured outer surface as shown Fig. 1B the one-dimensional photonic crystal coupler may direct the light to a focal point but beyond the focal point, the light spreads as a spherical pattern (4 of Fig. 1B). In contrast, a two dimensional photonic crystal coupler in accordance with the invention (Fig. 2) directs light out of the plane in one or more discrete directions (8 of Fig. 1C).

Claim 1 defines this invention as an optical device and, for outputting the light in at least one discrete direction, an "optical coupler [that] comprises a core region disposed between two cladding regions, the core having a two-dimensional photonic crystal grating to output the light in the at least one direction."

There is no comparable teaching in any of the cited references. The primary reference to Sakata is devoid of any discussion of the problems of photonic crystal couplers. Indeed, it is devoid of photonic crystals. The Examiner is correct that Sakata discloses lasers, gratings and photodetectors serially coupled along a common waveguide, but the gratings are Bragg gratings, not photonic crystal couplers. Moreover they operate not by directing light out of the waveguide plane but rather by directing light along the plane to the serially connected photodector.

The Examiner recognizes these deficiencies but proposes they can be remedied by the secondary reference to Tsunetomo. Specifically it is asserted that Tsunetomo describes a two dimensional photonic crystal that could be substituted for the gratings of Sakata. Applicants respectfully disagree.

It is well established that for a combination of patents to make obvious a claimed invention there must be some teaching or suggestion in the references which suggests the combination. Moreover, the proposed combination must be operable.

In the present case there is no suggestion of the proposed combination and it would be inoperable. As discussed above, a photonic crystal coupler directs light out of the plane of the waveguide (see applicant's Fig. 1C showing the light 8 directed out from the plane). Such a coupler substituted for the grating of Sakata would produce an inoperable structure. Rather than directing light to the serially connected photodetector, it would direct the light away from it. The proposed modification is neither suggested by the references nor operable. Accordingly, claim 1 and the remaining claims dependent thereon patentable distinguish from the combination of Sakata and Tsunetomo.

Claim 7 is similarly rejected as unpatentable over Sakata and Tsunetomo further in view of Kozlov ('902). However claim 7 depends on claim 1 and distinguishes from Sakata and Tsunetomo for the reasons described above. Kozlov, cited only for disclosure of a specific waveguide core material, does not remedy the deficiencies of Sakata and Tsunetomo.

In view of the foregoing it is submitted that claims 1-18 patentably distinguish all cited art and that this case is now in condition for allowance. Reconsideration and favorable action in this regard is therefore earnestly solicited.

Respectfully submitted,



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